AMENDMENTS TO THE SPECIFICATION

Please amend the specification as indicated hereafter. It is believed that the following amendments and additions add no new matter to the present application.

In the Specification: [Use ~~strikethrough~~ for deleted matter (or double square brackets "[[]]" if the strikethrough is not easily perceivable, *i.e.*, "4" or a punctuation mark) and underlined for added matter.]

Please amend the paragraph starting on p. 1, line 8 as follows:

This application is a continuation-in-part application, which claims priority to copending U.S. Utility Application entitled, "Enhancement, Stabilization and Metallization of Porous [s]Silicon," having Serial No. 09/820,412, filed March 29, 2001, and also ~~which~~ claims priority to copending U.S. Provisional Application entitled, "Novel Sensitive Porous Silicon Gas Sensor," filed on October 10, 2001, and assigned Serial No. 60/328,583, both of which are entirely incorporated herein by reference.

Please amend the paragraph starting on p. 1, line 20 as follows:

High surface area porous silicon (PS) substrates formed in wafer scale through electrochemical (EC) etching fall into two groups. PS substrates fabricated from aqueous electrolytes consist[s] of highly branched nonporous substrates while PS substrates fabricated from [a]an aqueous electrolyte are comprised of open and accessible macroporous substrates with deep, wide, well-ordered channels.

Please amend the paragraph starting on p. 4, line 6 as follows:

One of a number of embodiments of the present invention includes the treatment of PS substrates generated in an aqueous and nonaqueous etch with an $HCl(H_2O)$ solution,

which results in the stabilization and enhancement of the *in situ* PL of the PS substrates. More specifically, in an exemplary embodiment, in a post-etch treatment method, an $HCl(H_2O)$ solution can be used to enhance and stabilize the PL (*in situ*) from a PS substrate. In addition, in ~~an other~~ another exemplary embodiment, a method of treating the PS substrate with $HCl(H_2O)$ followed by an alcohol solution (*e.g.* methanol or ethanol) further enhances and stabilizes the PL (*in situ* and *ex situ*) of the substrate. A non-limiting illustrative example includes PS substrates that are treated in an aqueous hydrochloric acid and water ($HC1/H_2O$) solution and display a strongly enhanced *in-situ* luminescence; however, the PL decays rapidly in an *ex-situ* environment without treatment in alcohol, preferably a high purity alcohol such as methanol. An exemplary embodiment includes treating the PS with methanol (MeOH). Further, PS substrates treated in an HC1 (H_2O)/ alcohol solution (of at least 0.2 molar (*M*)) maintain their enhancement for extended periods of time. The PS substrate may be stabilized and enhanced by the presence of a chloride ion (Cl^-). The treatment appears to be independent of the method of preparing the PS substrate, implying that the chloride salt treatment largely stabilizes the surface states of the photoluminescent PS substrate. This stabilization may be demonstrated by various techniques including, but not limited to the following: scanning electron micrographs (SEM), which show the profound change which accompanies the HCl treatment of the PS surface; Energy Dispersive Spectroscopy (EDS) which, reveals chloride incorporation into the PS surface at strongly photoluminescent regions; and Raman scattering, which demonstrates that the PL is correlated with the creation of amorphous structural regions. All of these testing methods indicate the manner in which the chloride salt stabilizes the PS substrate.

Please amend the paragraph starting on p. 13, line 20 as follows:

The PS substrates PL at 620 nm is monitored after a sample, etched in a 20%

HF/MeOH solution, [is] washed in methanol, dried in air, and then placed in a tetrabutylammonium chloride (TBAC) in methanol solution. The TBAC concentrations used include 0.1*M*, 0.2*M*, 0.3*M*, 0.4*M* and 1.0*M*. These experiments can be used to compare directly to the NaC1/MeOH saturated solution results. The 0.1*M* TBAC solution leads to a PL intensity, which peaks at about 4300 counts, seventy five minutes into the bath cycle, and then monotonically decreases to about 1000 counts within 5 hours. The source of the PS luminescence is temporarily enhanced, but it is not being stabilized at longer time scales. When the chloride concentration is raised to 0.2*M*, the photon-count level increases moderately as the PL intensity peaks at about 4800 counts, now 150 min. into the bath cycle. The signal again monotonically decreases to about 1000 counts within 5 hours. This trend continues for the 0.3*M* solution as the PL intensity peaks at about 6500 counts, 240 min into the run; however, despite a significant peak photon count, an eventual drop-off <u>of</u> the PL signal is observed. The 0.4*M* chloride-ion solution again demonstrates an increased photon-count level (peak about 12000 counts). There is also a notable decrease in the rate of PL decay. This trend appears to reverse for the 1*M* concentrated $C1^-$ solution. Although the PS luminescence peaks on a shorter time scale, the PL peak level has dropped to about 6000 counts and also decays at a much more rapid rate, clearly paralleling that for the 0.1*M* and 0.2*M* solutions. Thus, for the tetrabutylammonium counterion (TBA^+), evidence is produced for a peak effective chloride-ion concentration but no evidence is produced for an extended stabilization of the PL signal with time.

Please amend the paragraph starting on p. 14, line 18 as follows:

~~In situ~~ <u>*In situ*</u> stabilization in HC1 solutions of varying concentrations is now discussed. The results obtained in saturated NaC1 and TBAC solutions emphasize the remarkable PL stabilization that is inherent to a PS sample bathed by a 6*M* HC1 solution.

Next, a comparison of various concentrations of HCl is conducted. The concentrations include 0.1*M*, 0.2*M*, 0.3*M*, 1*M*, 2*M*, and 3*M*. For a 3*M* HC1 solution in either water or methanol, the photon count rate is comparable to that for the 6*M* HC1 solution. The count rate is still rising after 6.5 h in dilute HC1, whereas it levels off at about 20000 counts in the 6*M* HC1/(H_2O) MeOH solution after approximately 2 h. Both bath solutions demonstrate a profound stabilizing and enhancing effect on the PS emission intensity.

Please amend the paragraph starting on p. 20, line 12 as follows:

The PS sensors can be used to detect gases or liquids. The PS sensors have a contact resistance between the front contact and the PS between about 10 and 100 ohms, 20 to 100 ohms, and preferably about 20 and 60 ohms. In addition, the PS sensors have a resistivity between about 0.01 ohm/cm^2 to 1 ohm/cm^2, and preferably about 0.1 ohm/cm^2 to 1 ohm/cm^2, where the resistivity includes the PS region. The PS sensors operate at a bias voltage of between about 1 and 20 millivolts, and preferably about 1 to 10 millivolts. In addition, the PS sensors have a sensitivity of between about 10 and 100 parts per million (ppm). However, the sensitivity may be lower since it is difficult to acquire an independently verified sample below 10 ppm. The contact resistance, the resistivity, the operating bias voltage, and the sensitivity of the PS sensors should be contrasted to other gas sensors that have [a] spreading resistance of about 200 kiloohms to 1 megaohm, have operating voltages between about 2 to 5 volts, and have a sensitivity between about 100 and 1000 ppm.

Please amend the paragraph starting on p. 33, line 17 as follows:

In still another embodiment, a portion of the PS region 19 can be coated with a thin film of a biomolecule to enhance the selectivity of the PS sensor towards a particular gas or liquid (*e.g.*, ~~glusose~~glucose). For example, the PS region 19 can be coated with a

thin layer of a biomolecule such as, for example, an antibody, a polypeptide, or a polynucleotide.

Please amend the paragraph starting on p. 36, line 13 as follows:

For the purposes of illustration only, and without limitation, embodiments of the present invention will be described with particular reference to the below-described fabrication method. Note that not every step in the process is described with reference to the process described in the figures hereinafter. Therefore, the following fabrication process is not intended to be an exhaustive list that includes every step required for the fabrication <u>of</u> the embodiments of the PS sensor 10.

Please amend the paragraph starting on p. 39, line 7 as follows:

The PS gas sensor was evaluated using an experimental setup that includes a small, 1/8th inch ID Tygon tubing sheathed onto 1/8th inch OD stainless steel tubing. The steel tubing was connected to a 150 millimeter Shield Industrial Flow meter (Air [p]<u>P</u>roducts, Inc.) and a stainless steel chamber, to which the PS gas sensor was mounted, with an internal volume approximately 1 cm^3. The PS gas sensor was electrically connected to a Solartron impedance analyzer (SI 1260, Solartron Mobrey, Houston, TX) and the impedance analyzer was connected to a PC computer for data acquisition running Z-view (Scribner Associates, Inc.). Open and short circuit calibrations were stored in the instrument to correct for cable impedance. The impedance of the PS gas sensor was measured over a frequency range 100Hz to 20 KHz with an integration time of 1 second. The impedance was found to be frequency independent. The time response was measured at a fixed frequency of 1 kHz, generally with a 10 millivolt RMS drive voltage at room temperature.